FEDERAL REGISTER NOTICE

[7590-01-P]

NUCLEAR REGULATORY COMMISSION

10 CFR Part 50

[Docket No. PRM-50-78]
Robert H. Leyse; Denial of
Petition for Rulemaking

AGENCY: Nuclear Regulatory Commission

ACTION: Petition for Rulemaking; Denial

SUMMARY: The Nuclear Regulatory Commission (NRC) is denying a petition for rulemaking submitted by Mr. Robert H. Leyse (PRM-50-78). The petitioner requested that the NRC's regulations governing domestic licensing of production and utilization facilities and associated guidance be amended to address the impact of fouling on the performance of all heat exchange surfaces in a nuclear power plant. The petitioner further stated that the fouling of heat transfer surfaces is not adequately considered in licensing and compliance inspections, testing programs, and computer codes used for nuclear power facilities.

ADDRESSES: Copies of the petition for rulemaking, the public comments received, and the NRC's letter of denial to the petitioner may be examined, and/or copied for a fee, at the NRC's Public Document Room, located at One White Flint North, 11555 Rockville Pike, Public File Area O1F21, Rockville, Maryland. These documents are also available electronically at the NRC's Public Electronic Reading Room on the Internet at http://www.nrc.gov/reading-rm/adams.html. From this site, the public can gain entry into the Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's

public documents. For further information contact the PDR reference staff at (800) 387-4209 or (301) 415-4737 or by e-mail to pdr@nrc.gov.

FOR FURTHER INFORMATION CONTACT: Alan K. Roecklein, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, telephone (301) 415-3883, e-mail akr@nrc.gov.

SUPPLEMENTARY INFORMATION:

Background

The petition for rulemaking designated PRM-50-78 was received by the NRC on September 9, 2002. A notice of receipt of the petition and request for public comment was published in the *Federal Register* (FR) on October 31, 2002 (67 FR 66347). The public comment period closed January 16, 2003. Four letters of public comment were received in response to the FR notice.

The Petition

In PRM-50-78, the petitioner, Mr. Robert H. Leyse, requested that regulations be developed to require addressing the impact of fouling on the performance of all significant heat transfer surfaces in nuclear power plants (NPPs). The requested rule changes would also require that fouling impact be addressed in NRC-funded test programs and NRC-produced computer codes that are used to assess cooling and heat exchanger performance. The petitioner contended that fouling of heat exchange surfaces is not adequately considered in the licensing and compliance inspection of NPPs, for example, licensing bases and technical specifications do not specifically limit fouling on fuel elements. The petitioner also requested that regulations be

added to require publicly available performance reports on these surfaces, including records of mechanical degradation, and cleaning procedures and their effectiveness.

In addition, the petitioner contended that fouling would restrict fuel element cooling and that axial growth beyond design limits would cause fuel rods to bow, and contact other fuel rods and control rod guide tubes. The petitioner claimed that this would lead to a safety problem. In addition, the petitioner proposed that the rules should require investigating grossly off-normal performance of heat exchange equipment. For example, the petitioner stated that fouling of steam generator tubes should be investigated because it has occasionally reduced heat transfer effectiveness to force operation at below-normal secondary side pressure, creating a safety issue.

Public Comments on the Petition

Four letters of public comment were received on PRM-50-78. Two were from the petitioner, who noted in support of his petition that the ACRS did not address fouling of heat exchange surfaces during a meeting with Electric Power Research Institute (EPRI) in October 2002 and that one of the numerous heat transfer tests done for the NRC by Westinghouse (FLECHT Run 9573) resulted in tube failure. In addition, the petitioner noted that five additional Advisory Committee on Reactor Safeguards (ACRS) subcommittee meetings did not address fouling issues.

The Nuclear Energy Institute (NEI) opposed the petition, noting that current reporting requirements in 10 CFR 50.72 and 50.73 require reporting any event or condition that could interfere with a safety function of any system needed to shutdown that plant and maintain it in a

safe condition, remove residual heat, control radiological material, or mitigate accident consequences.

The Strategic Teaming and Resource Sharing (STARS) group, a consortium of nuclear utilities, opposed the petition noting that these same concerns were previously addressed by industry organizations in comments on PRM-50-73, PRM-50-73A, and PRM-50-76. In STARS view, this latest petition restates the same concern in a different context, without presenting any further evidence to provide a basis for revising the regulations. The STARS licensees plants believe that the requested additional reporting burden would not be justified by the unproven and questionable scenarios presented in the petition.

NRC Technical Evaluation

The NRC reviewed each of the petitioner's requests and concluded that none of the requests justified the initiation of rulemaking. The NRC's responses to each of the petitioners' requests are as follows:

1. Regulations are needed to address the impact of fouling on the performance of heat exchange surfaces throughout licensed nuclear power plants. The petitioner stated that this included fuel elements, steam generators, condensers, fan coolers, etc.

The NRC disagrees with the petitioner's assertion. The petitioner's assertion that regulations are needed to address the impact of fouling on fuel elements was addressed previously in a *Federal Register* notice of denial of PRM-50-73 and PRM-50-73A (also submitted by the petitioner) published at 68 FR 41963 on July 16, 2003. The petitioner did not submit any new information or provide any additional considerations that would cause the NRC to reconsider the denial of PRM-50-73 and PRM-50-73A.

In regard to other heat exchange surfaces, regulations and guidance addressing fouling effects on heat exchanger performance already exist for the primary and secondary sides of NPPs.

Specifically:

- 10 CFR 50.65 requires licensees to monitor performance parameters or to demonstrate that monitoring is not needed, and to provide preventive maintenance sufficient to ensure that all safety related structures, systems, or components (e.g., heat exchangers important to safety) are capable of fulfilling their intended functions.
- 10 CFR Part 50, Appendix A, Criterion 14 (or plant-specific principal design criteria in the plant design basis for plants issued construction permits before the effective date of 10 CFR Part 50, Appendix A), requires that the reactor coolant pressure boundary heat exchangers critical to safety (e.g., steam generators) be designed and tested to ensure an extremely low probability of abnormal leakage that might be caused by fouling or other factors. Steam generator tube performance is closely monitored by inspection as detailed in plant technical specifications. Technical specifications vary from plant to plant, but each pressurized-water reactor (PWR) plant has requirements to monitor steam generator tube performance.
- 10 CFR Part 50, Appendix A, Criterion 44 (and equivalent plant-specific criteria for pre-General Design Criteria (GDC) plants), requires provision of a cooling system to transfer heat from structures, systems, and components to an ultimate heat sink under normal operating and accident conditions. This heat transfer function is accomplished by structures and components (including heat

exchangers) in key safety systems such as the residual heat removal and essential service water systems.

- 10 CFR Part 50, Appendix A, Criteria 45 and 46 (and equivalent plant-specific criteria for pre-GDC plants), require the capability by design to perform inspection and testing of cooling water systems to ensure integrity and adequate performance. The technical specifications for each plant define limiting conditions for operation (LCO) for systems that mitigate design basis transients and accidents. The operability requirements for those systems defined in LCOs include the adequate performance of heat exchangers needed for the systems to perform their safety functions. The specific LCOs vary by plant type and format of the plant-specific technical specifications. However, each plant does have requirements related to safety-significant heat removal systems such as residual heat removal and safety-related service water. For a typical boiling water reactor, the LCOs include but are not limited to LCOs 3.4.9 and 3.4.10 for residual heat removal, LCO 3.5.1 for emergency core cooling, LCO 3.6.5.5 for drywell air temperature, LCO 3.7.1 for standby service water and ultimate heat sink, LCO 3.7.2 for high pressure core spray service water, and LCO 3.8.1 for diesel generators. Degradation of a heat exchanger that renders a system covered by an LCO inoperable would require completion of required actions, possibly including a shutdown of the affected unit, within the required completion times. The administrative requirements defined within all plants' technical specifications also require licensees to establish and maintain various procedures related to the operation and testing of plant requirement. A partial list of the required procedures is provided in Regulatory Guide 1.33, "Quality

Assurance Program Requirements (Operation)." The NRC routinely performs inspections of licensees' programs for implementing the required procedures.

- Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," July 18, 1989, recommended that licensees initiate test programs to verify heat transfer capability of all safety-related heat exchangers cooled by service water and routine inspection and maintenance programs to ensure serviceability of safety-related systems supplied by service water. Generic Letter 89-13 specifies that a continuing program for periodic retesting should address the effects of fouling, and licensees monitor parameters such as coolant flow, temperature, and pressure indicative of acceptable heat exchanger performance.
- The NRC oversees the licensees' testing and maintenance programs via the inspection and assessment procedures included in the reactor oversight process. The NRC inspection procedure IP 71111.07, "Heat Sink Performance," defines the current sampling and review process for NRC inspectors assessing licensees' programs for the testing and maintenance of safety-significant heat exchangers.
- Standard Review Plan (SRP) 4.2 also describes the NRC review of thermal margins, effects of corrosion products, and hydraulic loads. This review also addresses postulated fuel failure resulting from overheating of fuel cladding.
- SRP 4.2 describes the NRC review of licensee fuel design analyses to ensure that dimensional changes due to thermal or irradiation effects (such as fuel rod bowing or growth) are addressed.

Thus, the NRC does not believe that additional regulations are needed to address the impact of fouling on the performance of heat exchange surfaces throughout licensed nuclear power plants.

2. Fouling of heat exchange surfaces in reactors has the potential to cause significant safety problems.

The NRC acknowledges that, left undetected, excessive fouling of key heat exchange surfaces, or other problems that challenge the safety function of those heat exchangers, could represent a significant safety problem. The classification of the important heat exchangers as safety-related equipment, and the resultant requirements associated with their design and maintenance, demonstrates their importance. The NRC determined, for example, that the clogging of service water heat exchangers could have caused safety significant problems in the past and as a result issued several generic communications culminating in Generic Letter 89-13, “Service Water System Problems Affecting Safety-Related Equipment,” July 18, 1989. The NRC believes that the current regulatory requirements for the testing and maintenance of heat exchangers (as described in GL 89-13 along with recommendations for meeting the requirements), are adequate to identify and correct potential safety significant problems in safety-related heat exchangers. Consequently, the NRC has determined that no new regulations are required to address this issue. The NRC will continue to monitor the implementation of GL 89-13 and will, as it has in the past, take actions if adverse trends are observed.

3. NRC regulations must require publically available reporting on the performance of heat exchange surfaces, including records of mechanical degradation of heat transfer assemblies, and cleaning procedures and their effectiveness.

The NRC does not agree that it is either necessary or useful to report the routine operational matters involving heat exchanger degradation and cleaning which the petitioner proposes. The NRC is interested in system performance degradation when the situation might lead to a loss of safety function and regulations requiring such reporting already exist. 10 CFR 50.72, "Immediate notification requirements for operating nuclear power reactors," and 10 CFR 50.73, "Licensee event report system," require licensees to report on performance of any safety system in the primary or secondary sides of reactors if an event occurs that might compromise safe operating conditions, such as a deviation from plant technical specifications pertaining to residual heat removal systems.

Specifically, section 50.72(b)(3)(ii) requires reporting to the NRC within eight hours any event or condition that results in: (1) the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, or (2) the plant being in an unanalyzed condition that significantly degrades plant safety. In addition, section 50.72(b)(3)(v) requires eight hour reporting of any event or condition that could have prevented fulfillment of the safety function of structures or systems needed to: (1) shutdown the reactor and maintain it in a safe shutdown condition, (2) remove residual heat, (3) control the release of radioactive material, and (4) mitigate the consequences of an accident. Section 50.73 (a)(2)(i)(B) requires submittal of a Licensee Event Report (LER) within sixty days regarding any operation or condition prohibited by the plants' Technical Specifications, such as failure of a covered heat exchanger, and 50.73(a)(2)(ii)(A) requires an LER for any event or condition that resulted in the condition of the

nuclear power plant, including its principal safety barriers, being seriously degraded. The NRC believes that existing reporting requirements adequately address degradation of performance of heat exchange surfaces in nuclear power plants.

4. NRC regulations must address the need for investigating the grossly off-normal performance of heat exchange equipment in NPPs.

The NRC disagrees with the petitioner. The existing structure of regulations, technical specifications, reporting requirements, and licensee programs subject to NRC inspection provides the necessary confidence that plant safety systems, including heat exchangers, are properly designed and maintained. A discussion of the existing structure of requirements and programs is provided in the NRC response to the petitioner's first request. An additional regulatory requirement related directly to the need for investigating the degradation of heat exchange equipment and to take those actions necessary to ensure that the performance of the equipment will support its safety function is provided by, Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50. This regulation requires that conditions averse to quality, such as a significant degradation of a heat exchanger that is important to safety, be promptly identified and corrected. The NRC ensures compliance with these requirements by routinely performing inspections of licensees' programs for identifying and correcting problems.

5. Severe fouling of nuclear fuel elements leads to axial growth of the fuel rods beyond design limits as the operating temperature of the fuel rods becomes greater than allowed for in design. This would cause fuel rods to bow and contact adjacent rods and control rod guide tubes, interfering with coolant flow.

The NRC disagrees with the petitioner. Both pressurized water reactor (PWR) and boiling water reactor (BWR) fuel bundle designs provide ample space for fuel pins to expand in the axial direction. A PWR fuel pin is neither supported at the bottom nor at the top; instead, spacers are used to hold the fuel pins together. Designed space both at the bottom and at the top of fuel bundles permits fuel pins to expand thermally without touching any other structures. A BWR fuel bundle is normally seated at the bottom and there is no restriction to prevent thermal expansion into the upper plenum. Expansion springs are sometimes used between fuel pins to allow nonuniform axial expansion within a fuel bundle. For these reasons, the NRC considers it unlikely that a fuel pin will bow due to axial thermal expansion. SRP 4.2 requires the NRC to review licensee fuel design analysis to confirm that dimensional changes due to thermal or irradiation effects such as fuel pin bowing or axial growth are adequately addressed.

6. Fouling of heat-transfer surfaces is generally not adequately considered in the licensing and compliance inspections of NPPs.

The NRC disagrees with the petitioner. The effects of fouling of heat transfer surfaces are adequately addressed in the following NRC licensing and compliance inspection program elements:

- NRC license reviews include extensive NRC review of the licensee's design of key safety systems, structures, and components, including heat exchangers in the primary and secondary sides of a plant. NRC staff analyses of all key safety systems, including heat exchangers, are performed during development of NRC safety evaluation reports (SERs) pertaining to a license application. As previously discussed, various regulatory requirements such as 10 CFR 50.65, Appendix B to Part 50, and plant technical specifications require that licensees

maintain, test and restore equipment such that the safety functions are maintained consistent with the licensing of the plant. These processes are subject to NRC inspection to ensure that the requirements are met.

- Compliance inspections of safety systems, structures, and components, including safety-significant heat exchangers, are designed to determine compliance with Appendix A to Part 50, “General Design Criteria for Nuclear Power Plants.” Specifically, in the Reactor Oversight Program, Inspection Procedure 71111.07, “Heat Sink Performance,” requires that a sample of safety significant heat exchangers (e.g., for the residual heat removal, component cooling water, emergency core cooling systems) be inspected both annually for specific performance issues and biennially for an intense review of heat transfer characteristics.

7. The NRC must require by rule the inclusion of fouling considerations in NRC-funded heat transfer test programs and in the several heat exchanger computer programs produced by the NRC.

The NRC does not believe that these requirements need to be included by regulation.

- All NRC-funded computer codes used to audit emergency core cooling system (ECCS) performance are capable of considering the impact of fouling on the performance of fuel element surfaces, and these codes have been used for that purpose when warranted.
- Ongoing experimental and analytical test programs (e.g., Argonne National Laboratory study on fuel cladding performance) in the NRC Office of Nuclear

Regulatory Research (RES) are investigating transient and operational oxidation models, including effects of significant pre-oxidation.

- Calculations were performed by RES to support the evaluation of this petition using NRC computer codes. These calculations showed that fouling and excess pre-oxidation would not have a significant effect on reflood heat transfer capability.
- The NRC fuel performance code FRAPCON-3 can calculate enhanced oxidation from crud buildup on fuel element surfaces.
- The RELAP and TRACE codes use the FRAPCON information to calculate transient effects.

The NRC has evaluated the advantages and disadvantages of the rulemaking requested by the petitioner with respect to the four performance goals of the Commission.

1. Maintaining Safety: The NRC believes that the requested rulemaking would not make a significant contribution to maintaining safety because current regulations and regulatory guidance already address the effects of fouling of heat exchanger surfaces in NPPs. No data or evidence was provided by the petitioner to suggest that fouling of heat exchanger surfaces created any significant safety problems. Existing regulations, guidance, and practices provide for monitoring, detecting and correcting possible fouling effects on heat exchanger performance before any significant safety problems can occur. Thus, there would be no safety benefit from changing the regulations.

2. Enhancing Public Confidence: The proposed revisions would not enhance public confidence. Current regulations and guidance already address the effects of fouling on the performance of heat exchanger surfaces. The petitioner's request would require that

substantial, additional consideration be given to the effect of fouling on the performance of heat exchanger surfaces throughout the nuclear plant. The NRC does not believe that unnecessary and costly regulatory action to address a non-safety-significant issue would enhance public confidence in the safety of nuclear power.

3. Improving Efficiency and Effectiveness: The proposed revisions would decrease efficiency and effectiveness because licensees and the NRC would be required to generate additional information as part of the evaluation of numerous heat exchanger surfaces throughout the nuclear plant. Revising the regulations to be more specific about effects of fouling on heat exchanger performance would require an expenditure of NRC resources. Because no safety value would be added, this regulatory action would not improve NRC efficiency or effectiveness.

4. Reducing Unnecessary Regulatory Burden: Rulemaking in response to these petitions would change the regulations to specify addressing the effects of fouling on the performance of heat exchanger surfaces. Because existing rules and guidance already require that adequate attention be given to numerous heat exchanger performance criteria, as well as other phenomena, any rule change would be redundant. Licensees would incur minimal additional burden in modifying procedures but no benefit would occur.

Reasons for Denial

The Commission is denying the petition for rulemaking (PRM-50-78). As discussed above in the NRC technical evaluation, existing regulatory requirements (e.g., 10 CFR 50.65, Appendix A and B to Part 50, and plant technical specifications), require licensees to monitor and to perform preventive and corrective maintenance to ensure that all safety-related structures, systems or components are capable of fulfilling their intended functions. Generic Letter 89-13 recommended initiation of test programs to verify heat transfer capability of all heat-exchangers, and implementation of these programs is monitored closely by the NRC. The

Standard Review Plan specifies numerous tests, inspections, and surveillance plans to monitor heat exchanger performance.

The NRC has determined that none of the four performance goals of the Commission were met by any regulatory changes suggested by the petitioner.

NRC oversight of nuclear power plants includes the establishment of regulations, the issuance of operating licenses and technical specifications, and continual inspections and technical reviews of licensee programs and plant performance. When viewed in total, these regulatory requirements and related oversight practices provide confidence in the safety of operating nuclear power plants. The NRC's finding that no rulemaking is required, even though no specific regulation explicitly addresses the performance of heat exchangers, is based on the determination that the existing structure of regulations, technical specifications, and licensee programs subject to NRC inspection provides confidence that plant safety features, including heat exchangers, are properly designed and maintained.

The integration of the various requirements and related NRC oversight functions provide reasonable assurance that systems important to safety, such as heat exchangers, will perform their intended functions. The addition of specific requirements to a regulation to address heat exchanger performance is not necessary.

For these reasons, the Commission denies PRM-50-78.

Dated at Rockville, Maryland, this __ day of _____, 2004.

For the Nuclear Regulatory Commission.

Annette Vietti-Cook,
Secretary of the Commission